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NEW YORK CITY

N. A. C. A. BULLETIN

Vol. XX, No. 2 September 15, 1938

IN TWO SECTIONS

Section I

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Production and Cost Control in the Manufacture of Cutlery, by E. P. Dolliver..... 93

This Bulletin is published semi-monthly by the National Association of Cost Accountants, 385 Madison Avenue, New York. Subscription price, $10.00 per year. Entered at the Post Office, New York, N. Y., as second-class matter August 28, 1925, under the Act of March 3, 1879.

EDITORIAL DEPARTMENT NOTE

Probably many of the readers of this *Bulletin* have had the problem of adapting a cost and production control system to a company which was in dire need of control of its costs and productive activities but where, for various reasons, the operating cost of such a system had to be kept to a minimum. Such a problem was faced and solved in the company whose practice is described in this issue of the *Bulletin*. It would be hard to imagine a series of manufacturing operations with more variations than outlined in this article. How these variations were controlled and adequate cost data obtained while the cost of the system was kept at a minimum, is clearly portrayed in this article.

Our author is Elson P. Dolliver, who graduated in 1927 from the Engineering School of Tufts College with the B. S. degree in Electrical Engineering. The following year was spent with the Westinghouse Electric & Mfg. Co., where Mr. Dolliver continued his education in the Westinghouse Student Training Course. His industrial experience had been further supplemented by a year as Foreman with the Hood Rubber Company when, in 1929, he joined the United States Rubber Company as Industrial Engineer. Later, for two years (1933-35) he was engaged in sales control work with this company. In 1935, he took up his present duties as Industrial Engineer with R. Wallace & Sons Mfg. Co. of Wallingford, Conn. Mr. Dolliver is a member of the New Haven Chapter and in 1937-38 served as its Director of Publications.

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SEPTEMBER 15, 1938

PRODUCTION AND COST CONTROL IN THE MANUFACTURE OF CUTLERY

By E. P. Dolliver, Industrial Engineer,
R. Wallace & Sons Mfg. Co., Wallingford, Conn.

Introduction

THE manufacture of cutlery in our plant presents many interesting and difficult problems of control from a production and a cost standpoint. In the first place, we manufacture a line of cutlery to go with each of our various lines of flatware, which carries us through a price range from a knife retailing for five cents to a stub retailing for upwards of two dollars. In this group are some hundred and twenty-five items of various constructions requiring from seven or eight to sixty or seventy operations, depending on the item. The volume on any one item is neither large enough nor continuous enough to permit so-called straight line manufacture. The sales demand is such that the orders received during one week frequently call for more of a particular item than had been sold in the previous four or five months. Combined with this are almost daily requests for special items, that is, for a knife with a particular type of finish, or a special brand name etched on the blade, or for any one of a number of details that require special treatment.

Brief Description of Process

The cutlery group consists of various types of knives such as dinner, dessert, grill, steak, duck, carver, breakfast, child, etc. These types are further subdivided according to the nature of their construction, namely, one-piece knife, two-piece knife and stubs.

One-piece knives are forged either hot or cold from a round bar of metal. The metal used is either stainless steel, stainless iron, or high or low content carbon steel, depending on the particular class of knife. The forge blank is then heat treated or tempered and cut out to shape in a power press. From that point on, the various types go through many various processes depending on the final finish that the completed product is to have. A typical knife would move through the following processes: cutting out, grind

blades, ruff finish handles, rims and bolsters, tumbling, glazing, mirror finishing, final handle finish, kennel, final blade finish, plate, cut silver from neck, color blade, finish handle, inspect and pack. This particular treatment may apply to only one item in the line, whereas another knife out of the same blank would follow an entirely different routine of manufacture, depending again on the ultimate finish which the knife is to receive. Frequent inspections are necessary to control quality. The high color or finish given the knives in the final operations reveal and magnify defects that are scarcely visible in the preliminary operations. This condition brings about the necessity for extra operations and reoperations to put the knife into shape so that it will pass final inspection.

Two-piece knives are, as the name implies, made up from two pieces of metal. Usually a handle forged out of carbon steel cut out to shape and slotted or drilled is riveted or assembled in a press or drop hammer to a stainless or carbon steel blade cut to shape and inserted in the slot or drill hole in the handle. From the point of assembly on, the process varies widely for each type of knife. Some go through for silver plated handles, some for chrome or nickel, others for tin plating, etc. The operations on two-piece are fewer than on one-piece knives and are to a large extent machine operations, as against many more hand operations on the one-piece construction.

Stubs are forged blades which are soldered into hollow handles to go with the higher grades of plated and sterling flatware. The blades are forged, hardened, tempered and cut out, after which they proceed through from sixty to seventy hand and machine operations to the point of assembly with the hollow handle in another department.

The foregoing paragraphs briefly describe the processes. They involve a vast amount of detail. We may make 25 dozen of one item in a year and 100,000 dozen of another item, with process time varying from four days to four months for various constructions. The total dollar and cent volume and the intensive competition in the manufacture of cutlery make it necessary to keep expenditure for controlling production and costs at a bare minimum, yet we must have a positive control of these factors. To this end we have developed a system which has worked out very nicely for us.

Cost Procedure

Each type of knife is set up on a separate cost sheet (Exhibit 1 at the end of this article) on which is listed the various labor operations and their costs, grouped to show totals for the forging room, the handle finishing room and the cutlery finishing room. These three rooms comprise the major divisions of the cutlery process and are under the direct supervision of the cutlery department head. To the sum of the direct labor operation costs is added a percentage to cover such refinish and extra operation costs as have proven necessary in the manufacture of the item. These total cutlery room labor costs are transferred to a summary cost sheet (Exhibit 2) which includes plating and finishing labor together with the quantity and cost of materials, including packing supplies such as boxes and cases. The overheads are also applied on this summary sheet, each class of knife having its particular burden rate.

In order to determine the relative direct labor operating efficiency of the various rooms through which the work passes, we cost the production of each room each week at the standard direct labor allowances for each item produced and determine the ratio to actual direct labor payroll for the room. We subdivide this in the cutlery rooms into the standard and actual labor costs for the three major classifications, two-piece knives, one-piece knives and stubs, so that we can more readily isolate the high cost classifications for further scrutiny if necessary. To the standard labor for each classification for each room is added the standard burden, and the totals are added to the work-in-process inventory. A report of metal cut up each month is accumulated and priced by the accounting department, and forms the entry for the material charge to the work-in-process inventory.

Production Control Procedure

In view of the many and diverse processes in the manufacture of our line of cutlery and the necessity for indicating to the manufacturing department supervisors, truckers and operators just what operations and sequences are planned for the particular knife, we adopted a coupon control system. On a coupon strip (Exhibit 6) we list each operation on a separate coupon,

where it is done, the rate, and the total earnings for producing the work in the standard batch. In addition to this we include a coupon for the production credit to the room for performing the work and such coupons as we need for production follow-up. This coupon strip represents the order to the manufacturing department to produce the knives and is issued by the production control office to the manufacturing department. A control of coupon numbers issued is maintained in the production control office.

The coupons are produced from duplicator masters which we have built up for each item in the line, and are run off on a liquid type duplicator. The advantage of this setup for masters is great inasmuch as we can run one coupon or one hundred coupons from a master, depending on the quantity we want to order at one time, and can file the master away for use when we want to order again the next day, next week or next year. We feel that this coupon system gives us the following advantages:

(a) A knowledge that only the operations called for in the cost sheet will be performed on the knife. There are such a multiplicity of operations which could be and are performed on similar knives that it is almost impossible for supervisors, truckers or operators to carry them in their heads for all the different items. Two knives from the same blank which are identical in every way except in the final finish may parallel in operations through 90 per cent of the process. The coupons indicate the routing and thus prevent more operations than are necessary on a lower grade finish knife, and at the same time insure adequate operations on a higher grade finish knife so that it will plate and finish up to standard.

(b) We feel sure that the right piece prices or standards are being applied to the jobs and the payroll clerk has merely to add up the coupons handed in by each man to compute his pay.

(c) The number of the operator who performed each operation appears on the leader coupon so that it is possible for supervisors to check back on faulty work from the inspection points.

(d) In determining the standard cost of our production for each room, we merely add up the amounts shown on the production or "sent-out coupon" which is torn from the strip and sent to the cost department as the batch is sent from the manufacturing room with their operations finished.

(e) A good follow-up for production control purposes is possible inasmuch as batch numbers are checked to the records from the coupons torn off at various key stations and sent to the production office.

(f) Extra operations and reoperations are readily apparent to the supervisor as there is no coupon provided for operations other than standard and the supervisor has to approve payment for all non-standard operations. Through the use of special work tickets for these extra operations, this excess cost information can be readily brought to the attention of the cost department.

(g) Each batch is counted and checked at the various inspection points to insure that we are getting the count which we pay for on the coupons.

(h) We feel that there is less chance for error inasmuch as the information is duplicated from a master which has been carefully checked for accuracy.

Detail of Production and Cost Control

1. From sales posted weekly to stock record cards (Exhibit 3) we find that we need 50 dozen 7392 Sherwood two-piece chop knives.

2. The stock control clerk makes out an order on the order form (Exhibit 4) for 50 dozen 7392 Sherwood.

3. The schedule for the week is prepared, listing all orders which are to be manufactured. (Exhibit 5.)

4. The masters for the 7392 Sherwood are withdrawn from the file and two sets of coupon strips (Exhibit 6), calling for 25 dozen each, are run off and the master is filed for future use. Let us assume that one coupon strip starts with the riveting or assembly operation in the forge room and carries the work through to inspection in the cutlery finish room. The second coupon strip carries the batch from the inspection point through the finishing

processes to the final inspection and packing. The coupon strip numbers are entered on the order to be used in followup.

5. The stock control clerk posts the stock record from the order which is then filed in a visible file. Necessary deductions from process stock for handles and blades are made by the clerk at this point.

6. The coupon strips are sent out to the manufacturing rooms. In this case one goes to the forge room and the other to the cutlery finish room.

7. The trucker withdraws from physical stock the number of handles and blades called for on the order and delivers them with the coupon strips to the rivet operation. The handles and blades are riveted and the operator detaches the first coupon, indicates his clock number on it and on the leader coupon, and places the balance of the coupon strip in the box with the standard 25-dozen batch of knives. At the end of the day the operator turns his coupons into the office from which point they are sent to the payroll department.

8. The batch of work goes through successive operations up to the point of inspection.

9. The inspectors look over the batch and record on the coupon the number passed and the number rejected. Those rejected are returned for reoperation on a refinish ticket (Exhibit 7). A 25-dozen batch of good work is made up, the second coupon strip is placed with this and the batch is sent on through the successive operations. A record of batches passed inspection at this point is sent to the production office.

10. After the last operation has been performed in the cutlery finish room (similarly in the forge room), the sent-out ticket is detached and sent to the cost department. These coupons are accumulated weekly and a "Sent-Out Cutlery Report" (Exhibit 8) is prepared from them by the cost department. This report forms the basis for credits to the cutlery finish room for the standard direct labor allowance on the three classifications, two-piece knives one-piece knives and stubs. This report is sent to the payroll department where it is used to build the labor analysis report (Exhibit 9) prepared weekly for the various major manufacturing units. A summary of direct labor, actual and standard, is pre-

pared monthly from this data by the cost department. (Exhibit 10).

11. The sent-out coupons are posted to the order cards in the visible file and serve as a medium through which the progress of the work is followed. The totals for each item for the week are also posted to the stock record card.

12. After leaving the cutlery department, the work goes to a central finishing unit serving all products and located physically some distance from the cutlery department. This work may or may not pass directly through to the packing room, depending on the immediate sales demand for the particular item and the condition and size of the packaged stock in the packing stock room. The finishing unit is used as a sort of reservoir to supply the packing room stocks. This makes possible a greater flexibility in supplying the various finishes that may be ordered, and also expedites the assembly of orders calling for special set packing. An item in the final finishing unit, which is in reality a part of our packing and stock room setup, can be finished and shipped usually on the same day that it is requisitioned by the packing room. To assist the packing room in locating the item in any of the four rooms comprising the finishing unit, we maintain what we call a "post office" in the packing room. Here we accumulate by patterns (designs stamped onto the handle of the various pieces comprising the line) "post office" coupons which are detached when the batches arrive from the manufacturing units. As the work passes through the various finishing rooms, a move coupon is detached and sent to the post office where a clerk matches up daily the move coupon with the post office coupon and punches a hole in spaces provided to indicate that the batch has passed through that particular finishing room. Inasmuch as we may have upwards of 2,000 batches of various kinds of work going through the finishing processes at one time, this "post office" setup provides a ready means of locating a batch in case it is wanted to complete an order or replenish stock. Samples of post office and move coupons are shown as part of the coupon strip.

13. As the batch is completed through to final inspection and packing, a separate report is made by the inspectors showing batch number, description, quantity passed, and quantity rejected. This is sent to the production control office where an entry is

made to the stock record and the entry on the follow-up card is closed out. All work rejected is returned on a special refinish ticket for the necessary reoperations to put it into shape to pass inspection. Upon receipt of the packing move ticket, the post office clerk removes the post office ticket from the file.

Conclusion

The adoption of this combined production and cost control procedure through the medium of the coupon strip has given us a positive control over a process honeycombed with detail, yet the clerical expense for its operations is very low compared with the results we are achieving.

Article ..... No.....

Cost of Material per .....

First Made .....
Revised to .....
..... Lbs. @ = ...
..... " Scrap @ = ...
Net Cost .....

Cost of Operation

FORGE ROOM	HANDLE FINISH	CUTLERY FINISH	CUTLERY FINISH

EXHIBIT 1

CUTLERY

COST OF

	Date						
	Stock Blade Stock Handle Stock Total Scrap Net Metal						
	Forging Room Handle Finishing Cutlery Finishing Chrome Plating Silver Plating Butler Finishing Scratch Brushing Machine Burnishing Hand Burnishing Buffing						
	Total Labor % Mfg. O. H. Labor % Mfg. O. H. dwts. Silver @ Net Metal						
	Total % Com'l O. H Boxes No. @						
	Standard Cost Inefficiency						
	Cost per Gross Cost per Dozen						

EXHIBIT 2

PLATE 1. But. Ox HOLE S.S Mirror BLADE 100 MIN STOCK ITEM 7392 SHERWOOD
AND 2. Nic Pl. " SS Mirror " 50 " "
FINISH 3 " " " " TAKE FROM 7392 Hdle - 7392 Blade
BATCH 25 ROTEN

DATE	BOOKINGS			EXPOSURE			PASSED INSPECTION			SENT OUT CUTLERY			PRODUCTION ORDERS			
	BUTLER OXIDIZE	NICKEL PLATE	SPEC	BUTLER OXIDIZE	NICKEL PLATE	SPEC	BUT OX	NIC PL	SPEC	BUT OX	NIC PL.	SPEC	DATE	ORDER NO	QUANTITY	TOTAL ORDD YEAR & DATE
1933	1250	565	25										1/20	CP1235	50	50
1934	986	500														
1935	1569	660	10													
1936	1890	203	6													
1937	1009	490	16													
EST	800	400	10													
INV				169	85	0										
1/8	45	1	0	124	84	0										
1/15	25	6	0	99	78	0										
1/22	10	1	0	89	77	0										
1/29	11	0	0	P45 123	77	0	45			50						
2/5																
2/12																
2/19																
2/26																
				Note 1 figures used are for purposes of illustration only												

EXHIBIT 3

ORDER NUMBER	QUANTITY	TYPE DESCRIPTION
CP 1235	GROSS	7392 Sherwood
SCHEDULE 4	50-0 DOZ.	
	PIECES	
DATE 1-20-38	NUMBER OF BATCHES 2	

A29 5m 1-37 HAC

EXHIBIT 4

CUTLERY DEPT. PRODUCTION SCHEDULE
MAKING ORDERS

January 20, 1938

Schedule #4

Strike - Finish - Send to N.F.W. Packing Room

CP-1235 50 dozen 7392 Sherwood

EXHIBIT 5

1/22 610.....715.....819..... Forge
612.....1000..... 7392 SHERWOOD 2/c
5719 701.....619..... Chop Knife
Sch 4 703.....800.....

1/22 819 Inspect Ck No.....
7392 SHERWOOD 2/c Chop Passed.....
5719 Rejected.....
Sch 4 Cut. f in. Group Bonus Total.....

1/22 800 Wash Ck No.....
7392 SHERWOOD 2/c Chop
5719
Sch 4 Cut. Fin. 25 - .005 - .125¢ Total

1/22 619 Strike Ck No.....
7392 SHERWOOD 2/c Chop
5719
Sch 4 Forge Room 25 - .02 - .50¢ Total

1/22 1000 Plate Ck No.....
7392 SHERWOOD 2/c Chop
5719 1 dwt. on handle
Sch 4 Mach. Plate 25 - .005 - .125¢ Total

1/22 715 Finish Handle Ck No.....
7392 SHERWOOD 2/c Chop
5719
Sch 4 Han. Fin. 25 - .025 - .675¢ Total

1/22 703 Ruff Bolster Ck No.....
7392 SHERWOOD 2/c Chop
5719
Sch 4 Han. Fin. 25 - .02 - .50¢ Total

1/22 701 Ruff Rims Ck No.....
7392 SHERWOOD 2/c Chop
5719
Sch 4 Han. Fin. 25 - .015 - .375¢ Total

1/22 Sent Out Cutlery - Forge Room
7392 SHERWOOD 2/c Chop
5719 25 - .055 - $1.375 Total
Sch 4 To Cost Dept.

1/22 612 Weld Ck No1.....
7392 SHERWOOD 2/c Chop
5719
Sch 4 Forge Room 25 - .015 - .375¢ Total

1/22 610 Rivet Ck No1.....
7392 SHERWOOD 2/c Chop
5719
Sch 4 Forge Room 25 - .02 - .50¢ Total

EXHIBIT 6

S. H. CUTLERY BACK WORK

251 DESC. _____
QUAN. _____
REASON _____

Returned by

S. H. CUTLERY BACK WORK

251 (1)_____ (5)_____
(2)_____ (6)_____
(3)_____ (7)_____
(4)_____

Quantity _____
Type _____

S. H. CUTLERY BACK WORK

251 (7)

Ck. No._____
Rate_____
Amt._____

S. H. CUTLERY BACK WORK

251 (6)

Ck. No._____
Rate_____
Amt._____

S. H. CUTLERY BACK WORK

251 (5)

Ck. No._____
Rate_____
Amt._____

S. H. CUTLERY BACK WORK

251 (4)

Ck. No._____
Rate_____
Amt._____

S. H. CUTLERY BACK WORK

251 (3)

Ck. No._____
Rate_____
Amt._____

S. H. CUTLERY BACK WORK

251 (2)

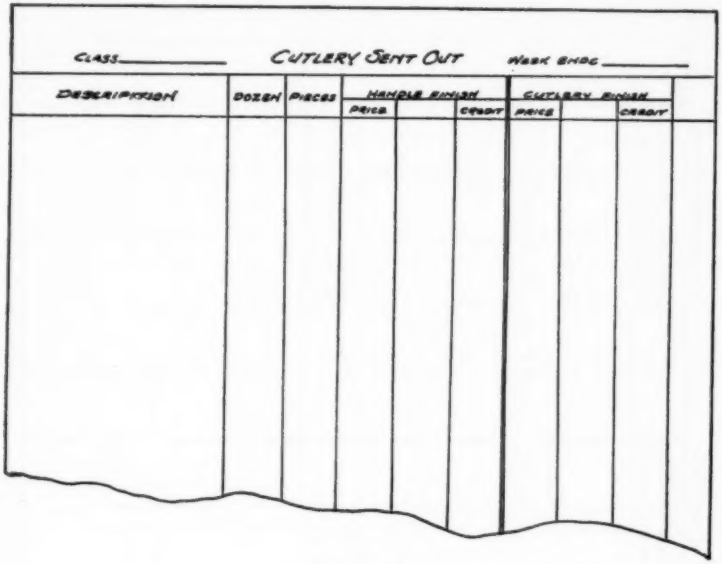
Ck. No._____
Rate_____
Amt._____

S. H. CUTLERY BACK WORK

251 (1)

Ck. No._____
Rate_____
Amt._____

EXHIBIT 7



CLASS _____ CUTLERY SETT OUT WEEK ENDG _____

DESCRIPTION	DOZEN	PIECES	HANDLE RIVER			CUTLERY RIVER			
			PRICE		CREDIT	PRICE		CREDIT	

EXHIBIT 8

ROOM EFFICIENCY ANALYSIS Room

Per	Labor	Month Output	%	Year to Date Labor	Year to Date Output	Year to Date %	Last Year to Date Labor	Last Year to Date Output	Last Year to Date %	Comparison %
J										
F										
M										
A										
M										
J										
J										
A										
S										
O										
N										
D										
T										

EXHIBIT 10

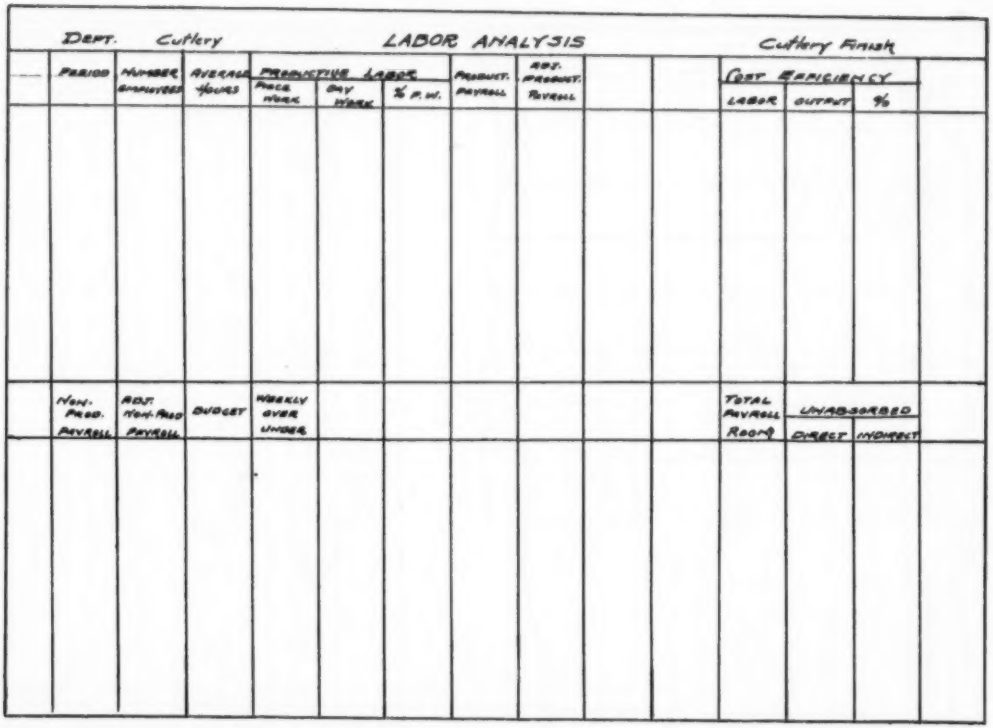


EXHIBIT 9 OBVERSE

DEPT Cutlery — Cutlery Finish

1938 PERIOD	1-pc KNIVES		2-pc KNIVES		STUBS		TOTAL			WEEKLY		CUMULATIVE
	STD'D	ACTUAL	STD'D	ACTUAL	STD'D	ACTUAL	STD'D	ACTUAL	%	OVER	UNDER	

EXHIBIT 9 REVERSE

You Will Find

VITAL TOPICS

Distribution Cost in Relation to Price

Increased Profits Through Better Control of Sales Personnel

Stable Tax Policy and the Control of Profits

Proposed Revisions in Federal Income Taxation

Taxes as an Element of Cost and Their Expression on Financial Statements

OUTSTANDING SPEAKERS

W. Mason Smith, Director of Personnel, Marshall Field & Co., Chicago, Ill.

Dr. James W. Morton, Commissioner of Revenue, Commonwealth of Kentucky.

Victor H. Stempf, Partner, Touche, Niven & Co., New York, N. Y.

Professor J. Brooks Heckert, Ohio State University, Columbus, Ohio.

William R. Donaldson, Partner, Miller, Donaldson & Co., New York, N. Y.

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at the

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Ohio Valley Chapters

September 29 and 30, and October 1, 1938

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